

QUARTERLY PROGRESS REPORT

Cooperative Agreement Number R 82806101-0

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Title: The Pittsburgh PM Supersite Program: A Multidisciplinary Consortium for Atmospheric Aerosol Research

Principal Investigators: Spyros Pandis, Cliff Davidson, and Allen Robinson

Institution: Carnegie Mellon University

Project Period: April 15, 2000 - July 14, 2000

Investigators: Spyros Pandis, Cliff Davidson, Allen Robinson, Neil Donahue, Andrey Khlystov (*Carnegie Mellon Univ.*), Anthony Wexler (*UC Davis*), Murray Johnston (*Univ. of Delaware*), Wolfgang Rogge (*Florida Intern. Univ.*), Mark Hernandez (*Univ. of Colorado*), Jeff Collett (*Colorado State Univ.*), Susanne Hering (*Aerosol Dynamics*), Jonathan Kahl (*Univ. Wisconsin*), Barbara Turpin (*Rutgers Univ.*), John Ondov, Steven Buckley (*Univ. of Maryland*), *RJ Lee, Inc.*, Kevin Crist (*Ohio University*), Antonio Miguel (*UCLA*), Delbert Eatough (*Brigham Young University*), Urs Baltensperger (*Paul Scherrer Inst.*), Phil Hopke (*Clarkson U.*), Jonathan Samet (*Johns Hopkins*), Richard Sextro (*LBNL*), William Aljoe (*DOE-NETL*).

Objectives: Characterization of the atmospheric aerosol in the Pittsburgh region. Development and evaluation current and next generation atmospheric aerosol monitoring techniques. Quantification of the impact of the various sources to the PM concentrations in the area. Elucidation of the links between PM characteristics and their health impacts. Quantification of the relationship between indoor and outdoor concentrations. Study of the responses of the PM characteristics to changes in emissions.

Work Status: The CMU team has finalized the design of the structure that will be used for the sampling activities in Schenley Park. The Art commission of the city of Pittsburgh approved the design. A number of meetings with the Pittsburgh City Planning Department were held about the details of the project. An agreement between CMU and the City of Pittsburgh was prepared. We are currently expecting the final approval of the city.

The Supersite team compiled lists of power and space site requirements for all the groups. The CMU team is making arrangements with Duquesne Light to provide the necessary power to the site.

The preparations for the renovation of the existing space and the construction of the new CMU Air Quality Laboratory continued during this period. The laboratory is expected to be ready in January of 2001, four months before the beginning of the Supersite operations.

The project team continued its coordination efforts with representatives of the state and county air pollution authorities as well as with the other Eastern US Supersites. July of 2001 has been chosen for the first intensive period of all Eastern Supersites. The original plan of the Pittsburgh team was to have a two-week intensive period during this month. After discussions with EPA and the other Supersites the team has agreed to increase the duration to the full month with small modifications to the original sampling schedule. A meeting with representatives of the MARAMA states is scheduled for the end of October in Pittsburgh. Preliminary conversations were held with Randy Hock of the Ohio EPA regarding the location of their speciation site and potential collaboration during the intensives. The Eastern Ohio speciation site will likely be either in Steubenville or Mingo Junction along the Ohio River. Mr. Hock thought that they might be able to collect daily samples during intensive periods.

The CMU team has started preliminary measurements in the area. The goals of these measurements are to test the various instruments and techniques and also to learn more about the atmospheric aerosol in the area. This information could help improve the design of the Supersite measurement strategy. The real time aerosol size measurements (ultrafine and regular Scanning Mobility Particle Spectrometers and Aerosol Particle Sizer) indicated that there are no significant near-by sources affecting the proposed measurement site. The size measurement system was able to provide high-resolution size distributions from 3 nanometers to 10 micrometers at ambient relative humidity every 5 minutes. An automatic RH control system has been developed that switches the RH of the sampled aerosol from ambient to 30% every 5 minutes. The system will

be coupled with the size measurement instrumentation for the automatic continuous measurement of the aerosol liquid water content distribution.

A thermal-optical organic aerosol analyzer was ordered and received from Sunset Laboratories. The instrument was installed in the Carnegie Mellon University Air Quality Laboratory. Sunset Laboratories trained two graduate students in the operation of the instrument. Since delivery the instrument has been calibrated using sucrose and calcium carbonate standards. The instrument is now fully operational, and the Standard Operating Procedure for the instrument is being written up. Procedures have been developed to handle the quartz filters for handling. Blank levels for the quartz filters are typically less than 0.2 micrograms per square centimeter of filter material.

The prototype of the Pittsburgh Supersite Organic sampler has been constructed. The sampler consists of a URG PM₁₀ inlet, a URG PM_{2.5} cyclone, a denuder, and a filter pack. Experiments have been initiated to characterize the performance of the system with different denuder and filter combinations. Three different denuder configurations to remove volatile organics from the sample stream are under consideration: 1) honeycomb activated carbon denuder (MAST Carbon Ltd.), activated carbon Mini-BOSS denuder (provided by Prof. Delbert Eatough of BYU), and 3) an XAD-coated URG denuder. Experiments are being conducted in both the laboratory and in the field to characterize the particle penetration and organic vapor gas capture efficiency of these different denuders. Three different back-up filters are under consideration to characterize negative artifact caused by volatilization of organic aerosol captured on the quartz primary filter: 1) a second quartz filter, 2) a carbon impregnated filter (Schleicher & Schuell Inc.), and 3) an activated carbon mesh. Procedures are being developed to prepare, analyze, and interpret the results obtained using carbon back-up filters. Experiments are being performed in both the laboratory and in the field to characterize the capture efficiency of organic vapor by the different back up filters. We anticipate that the organic sampler design will be finalized by the end of the year. As part of the organic sampler characterization, a mini-sampling campaign has been initiated to provide preliminary characterization of the organic aerosol in the Pittsburgh region. Samples are being collected on the Carnegie Mellon University campus near the central Supersite and the various satellite sites around Pittsburgh. The Rogge group will speciate some of these samples.

Colorado State University (CSU) has begun work on improving the automation of the continuous analyzers for gaseous total soluble peroxides and organic peroxides. The difference between these two channel readings corresponds to the hydrogen peroxide concentration. Work to date includes evaluating small micro-metering pumps for the delivery of reagents in the analyzers. Initial tests suggest these pumps provide several advantages over the peristaltic pumps used previously: they deliver a sample stream to the fluorimeter with less pulsing, thereby reducing noise in the monitored signal, and they reduce the maintenance previously required to change peristaltic pump tubing at weekly intervals.

The overall project is proceeding according to the original schedule and the reported progress is consistent with the goals and objectives for the period of the report. The aims of the project have not changed from the original application.

Changes in Key Personnel Involved in the Project: Dr. Phil Hopke (Clarkson University) has joined to the Pittsburgh Supersite team. Dr. Hopke will be funded by the DOE part of the project and will contribute to the fine PM source apportionment component of the project using a variety of statistical methods. Dr. Neil Donahue has been recently hired by CMU as a professor in the Chemistry and Chemical Engineering departments and he has joined the Supersite team. He will be responsible for the gas-phase measurements of the project. The CMU team has made arrangements to hire another senior researcher with extensive experience in aerosol field measurements.

Expenditures to Date: During the first six months of the project the Supersite team has used approximately 60% of the budget for the corresponding period. Delays in the preparation of subcontracts were the main cause for this discrepancy with the budget. The project spending will be according to the original budget by the end of the winter.

Quality Assurance Requirements: The Quality Assurance/Quality Control plans for the project are coordinated with the other six Supersites and EPA. The QAPP for the project will be sent to

EPA in the winter of 2000. Drs. Suzanne Hering and Cliff Davidson are currently managing the QA/QC activities of the project. The project team with the help of EPA looked without success for a QA officer who will not be participating in the sampling activities. The temporary solution is to use Dr. Hering as the QA officer, and Dr. Davidson as the QA assistant officer responsible for the continuous measurements of Dr. Hering.

Planned Activity for the Subsequent Reporting Period: Major activities planned for the third quarter of the project include:

- Continuation of the central sampling site preparation.
- Continuation of the construction of the Air Quality Laboratory and the corresponding clean rooms.
- Construction of the single particle mass spectrometer by the Wexler group using the lessons learned during the Houston Supersite activities this summer.
- Field testing of the relative humidity control systems for the real time particle sizing instruments
- Continuation of the pilot study in the central sampling location and a background site to test the particle sizing instrumentation, and the organic and inorganic samplers.
- Collection and speciation of organic aerosol samples from the central site and one upwind background site by the Rogge group
- Meeting of the Pittsburgh Supersite team and the Supersite PIs during the AAAR conference in St. Louis.

Supplemental Key Words: Airborne particulate matter, aerosol, size distribution, ultrafine, fine and coarse particles, atmospheric chemistry, source-receptor, measurement error, study design, epidemiology, regional modeling, source/receptor analysis, Pittsburgh, Ohio River Valley, Western Pennsylvania, photochemistry, meteorology, trajectory modeling, peroxides.

Relevant Web Sites: homer.cheme.cmu.edu